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Headache

Medical Supervision in Industry

The Framingham Health Demonstration and Industrial Medicine

Study of Accident Records in a Textile Mill

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HEADACHE*

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"HEADACHE" is certainly one of the most frequent complaints among industrial workers — any physician working in an industrial community knows this fact in a general way. This paper is written to focus our attention on headache as a symptom, and, by giving brief data collected in factories and department stores, to stimulate other workers in the field to make more extensive studies.

In a factory industrial unit employing 12,000 workers, Mock's (1) analysis of the cases of time lost in a year showed that in approximately 23 per cent. the complaint was headache (Table 1). One of us,† working in mercantile industrial units, found that from 10 to 15 per cent. of all employees asking for medical attention complained of headache. One department store had an average of 1,500 employees. Table 2 shows the number of cases seen each month and the number and percentage of these cases complaining of headache. In a smaller store employing about 800, with a greater number of women, a tabulation for four months showed even a larger percentage of headaches (Table 3). In both establishments more women than men were employed, and in the smaller store, where there was a larger percentage of female employees, the number of headaches was greater. Mock's figures also showed that more women com-

TABLE 1. — NUMBER OF LOST TIME CASES DUE TO HEADACHE AMONG 12,000 FACTORY WORKERS

Sex	No. of Cases of Lost Time in a Year	No. of Cases Due to Headache	Per Cent. Due to Headache
Male.....	6,420	1,255	19
Female.....	15,244	3,778	24

TABLE 2. — NUMBER OF CASES OF HEADACHE AMONG 1,500 DEPARTMENT STORE EMPLOYEES

Month	Total Cases Examined	Headaches	
		Number	Per Cent.
1st	670	64	9.5
2d	554	59	10.6
3d	767	65	8.4
4th	1,000	145	14.5
5th	775	84	10.8
6th	685	69	10.0

* Received for publication August 13, 1921.

† D. C. P.

plained of headache than men, in the ratio of 24 to 19. This is probably due to sexual differences — for example, menstrual difficulties and "nervous instability" — although the contention that women as a group are less stable than men cannot be shown conspicuously by any statistics with which we are familiar.

Francis A. Brugman (2), in the beginning of his recent paper, *Etiology of Chronic Headaches*, says that there are so many factors entering into the causation of headaches, and so many different ways in which the pain may present itself, that no particular pathological condition can be said to cause any particular kind of headache. He further says that some idea may be had of the problem confronting the diagnostician when one observer has given a list of 160 conditions which may cause headache. Hence only the more common conditions can be referred to here.

TABLE 3. — NUMBER OF CASES OF HEADACHE AMONG 800 DEPARTMENT STORE EMPLOYEES

Month	Total Cases Examined	Headaches	
		Number	Per Cent.
1st	651	100	15.3
2d	502	73	13.9
3d	541	80	13.7
4th	691	85	10.2

Most authors make painstaking classifications of the different forms of headache; for example, Brugman's division into *reflex*, *congestive*, *toxic* and *neurotic* is better than most classifications; but in all fairness we must admit that we know so little of the physiological pathology that to use the words, reflex, toxic and neurotic, is simply to cover our ignorance of the mechanism involved with vague names. Congestion we can easily demonstrate, for we know that a tight collar will cause a headache, and we can show in the laboratory that pressing on the jugular veins causes cerebral congestion and raises intracranial pressure.

Even though we know little definite about etiology, clinical experience has clearly indicated certain factors in the causation of headache, and additional evidence has been gained by therapeutic experiments. Therefore we will classify these headaches according to their probable etiology, considering first those causes which were most commonly met with in the department stores above mentioned.

The most frequent cause seems to have been the onset of *an acute infection*, usually of the upper respiratory tract — the common "cold" or "grippe." A liberal use of the clinical thermometer and a few questions will make the recognition of this type a simple matter. *Constipation* was next in importance. Here the headache is usually dull and diffuse, and the diagnosis is generally made from the history. But constipation is seldom an isolated cause; it is usually associated with *poor hygiene* — *e. g.*, lack of drinking water and other faults of diet, lack of sleep, and work at home as well as at the store, all contributing to make a picture of general fatigue. Frequently this is the forerunner of some incipient disease. Anemia may be an important factor.

This class of headaches, however, cannot be sharply divided from the great group of *psychoneurotic* headaches, for faulty mental hygiene usually leads to bad physical hygiene or *vice versa*, and a vicious circle is easily formed, from which the patient finds it impossible to escape. Advice as to regular habits, followed up by supervision, is often all that is necessary to break the circle. With the physical condition thus improved, the mental symptoms may become inconspicuous. While no one cause can be given in such a case, the combination of various circumstances at a given time burdens the patient to the breaking point. For relief it is not necessary to remove all the untoward circumstances, in fact it is

impossible—for we all carry some burdens, physical or mental—but a removal of part of the burden will usually allow the patient to get rid of the symptoms that are interfering with economic efficiency and happiness.

Many cases will be encountered, however, particularly in department store work, where simple rules of hygiene will do little good. These cases can be considered psychiatric, and a careful study will elicit emotional factors, poor adaptations, dissatisfaction with life, worry, or other environmental difficulties. For example, an employee may be worrying over decreased sales and fear of reprimands by superiors; another may be having difficulties in his home life, causing emotional instability; in both cases there is a resulting lack of energy and poor physical hygiene, for when our spirits are depressed our bodies feel "tired" and we do not have the energy to follow a healthful routine. The headache is a defence against irksome effort; the patient is unhappy, vaguely dissatisfied, and craves attention, pity, relief from monotony. A slight headache, which in another individual (or in this patient at another time) would cause no disability, is seized on as a means of escape from the situation and is exaggerated until the patient obtains the relief desired. These mental mechanisms are largely subconscious, and to tell such a patient that the headache is "imagination" is not only to show gross ignorance of the psychology involved, but it is bad therapeutics, since the patient is antagonized and can never be led to understand the real cause. Success is only obtained by sympathetic investigation of all the mental factors, followed by frank talks in explanation of the symptoms. In obtaining the facts in these cases, which are usually of a personal nature, a well-trained and tactful social worker is an invaluable adjunct to the medical staff.

Many psychoneurotic headaches are directly caused by neuromuscular tension. Whenever we are over-stimulated, uncontrolled and useless energy is likely to be spent by contracting the muscles of our neck, face, scalp, or even of our extremities. Common examples are seen in the set jaw and the drawn face. Such muscular tension long continued may set up definite headache; indeed, it is a common cause since the over-stimulation responsible for the tension may come either from external sources, such as continuous noise, or from internal emotional conflicts. Perfectly normal people subjected to stress often suffer thus, but the supersensitive psychoneurotic is much more susceptible.

In our experience, *eyestrain* was a frequent cause of headache. Clarke (3) considers it by far the commonest (quoting Lauder Brunton as saying that 90 per cent. of all headaches are due to eyestrain), but this would seem to be an exaggerated statement, unless we accept Charles' (4) theory that local eyestrain causes headache only when the patient is neurotic. These cases then would be classed with the great group of psychoneurotic headaches, and would be best explained by postulating that most normal people have slight feelings of pressure or other cranial discomfort after eyestrain, but that it is only in unstable people that this degree of pain amounts to disability. By what mechanism eyestrain produces headache, we do not know. Many elaborate theories have been advanced, the most reasonable of which seems to be that the effort of accommodating with a refractive error, or of converging in spite of a muscular imbalance, causes a muscular tension analogous to those described above. Even this theory gives little clue to the actual mechanism involved, although the fact that those headaches which are most relieved by glasses are usually frontal or orbital suggests that local muscular tension may be a factor.

The last group of headaches which could be considered common among these em-

ployees was the group arising from infections of the nasal sinuses. The pain in these cases is intense, and tenderness can usually be elicited over the offending sinus. The history of rhinitis and examinations by transillumination and X-ray will aid in the diagnosis.

Before going on to a discussion of the kinds of headaches less frequently encountered in this group of workers, it would be well to discuss a vague but important entity — the *fatigue headache*. This is such a mild symptom in most people that it seldom is brought to the attention of the physician. In psychoneurotic patients it is often the central symptom. It is a common experience that excessive work will cause a feeling of pressure about the head, as if the temple were clamped in a vice, or as if an iron band were pressing about the forehead. The precipitating cause of such discomforts may be either physical or mental strain. When arising from physical strain, fatigue headache usually occurs in an individual who is not accustomed to labor and who leaves his sedentary occupation to take a strenuous day in the open air. He feels well all day, but goes to bed with a slight headache and may wake up the next morning with a severe one. On the other hand, similar headaches arise from excessive indoor work — overtime — especially if the worker stimulates himself to keep up his task with coffee, tea, alcohol, or tobacco. These drugs, of course, complicate the picture, as any one of them may cause headache with its own toxin. Another thing to be considered is the environment in which the person is working: Is the room stuffy? Is it noisy? Is the light trying to the eyes? In fact, are there any stimuli which in an ordinary eight-hour day would cause no symptoms, but which in excess may be important sensory irritants?

It is our experience that persons who have unstable vasomotor systems are the ones most affected in this way — *i. e.*, those individuals who blush and sweat easily, whose heart rate and blood pressure vary quickly, and who in addition show active pupillary and tendon reflexes. Rest invariably brings about relief, or a dose of "salts" may more quickly cure. These facts, taken with the observation that the face is usually flushed and the temporal artery conspicuously tortuous and tense during the attack, direct our attention to the vasomotor mechanism, and make us believe that cerebral congestion is the probable cause. The fact that the administration of a hypertonic solution in the form of a dose of salts gives quick relief corroborates this theory, because it is known that such solutions quickly reduce intracranial tension (5). This explanation seems more material than the one frequently given that "fatigue toxins" cause the headache, but it must be admitted that the physiological products of fatigue in the sensory nervous mechanisms and in the muscles may well initiate the vasomotor changes.

Closely allied to these common but mild headaches is *migraine*. This, unlike many headaches, is not merely a symptom, but seems to be a clearly defined disease entity characterized by periodic paroxysmal attacks accompanied by nausea or vomiting. The disease is strongly inherited, 90 per cent. of the cases showing antecedents or descendants with the same trouble (6). The onset is almost invariably during childhood or youth. Less important symptoms are the unilateral distribution of the pain in about two-thirds of the cases, and the ocular prodromal phenomena in about one-fourth. At present there is no accepted explanation of the symptoms, but the most satisfactory theory seems to be that vasomotor changes cause an increase in the bulk of the cranial contents, thus putting painful tension on the dura.

Three other common causes of headache should be given special mention. In the first place, *syphilis* must be thought of in

cases where the pain is chronic, and a Wassermann test should always be made on the blood; even if this test proves negative a lumbar puncture and examination of the spinal fluid is advisable whenever the case is difficult to diagnose. Secondly, *brain tumor* is much more common than is generally supposed and severe headache may be the first symptom, vomiting, choked disc and neurological signs appearing later. The third is *rheumatic headache*, also called "indurative" or "nodular." This type has been well described by Patrick (7) and Auerbach (8). The cardinal features are persistent headache with fluctuations, usually in people over 40 years of age, and primarily located in the suboccipital region but radiating to the neck, shoulders, and vertex. Changes in the weather often increase the pain. Palpation of the scalp reveals small tender nodules, and in the muscles of the neck indurated areas may be felt. During an exacerbation, however, the neck muscles are so spastic that nothing is palpable. General examination may reveal arthritis, low fever, leukocytosis and focal infection usually in the head. Massage and heat applied to the head and neck give relief — procedures which increase the pain in most other forms of headache.

It is not pertinent to continue enumerating the causes of headache, but having drawn attention to those types most frequently met with, we may summarize with the following table, modelled on Table 1 in Auerbach's book.

TABLE 4. — CLASSIFICATION OF THE DIFFERENT FORMS OF HEADACHE

A. *The More Independent Forms of Headache*
   1. Migraine
   2. Fatigue headache
   3. Rheumatic headache

B. *Headaches Associated with Diseases of Individual Organs*
   1. Brain disease (meningitis, encephalitis, tumor)
   2. Organs of special sense (eyestrain, otitis)
   3. Digestive tract (constipation, hunger, gastric hyperacidity, jaundice)
   4. Kidney (nephritis)
   5. Vascular (congestion from tight lacing, tight collars, lumbar puncture, sunstroke or menstruation; hypertension; arteriosclerosis)

C. *Headache in General Diseases*
   1. Acute infections
   2. Chronic infections (syphilis, paresis, rheumatism)
   3. Intoxications (alcohol, lead, tobacco, ether, carbon monoxide, sulphuretted hydrogen, opium, iodoform, iodides)
   4. Constitutional diseases (anemia, diabetes, endocrine disorders)

D. *Psychoneurotic*

E. *Combinations of Different Forms*

From the foregoing discussion it is apparent that the diagnosis of headache is far from simple; the examination of the patient must, therefore, be painstaking and prolonged. It would be impossible to outline a reasonably complete examination to cover all cases, but a brief account of what should be done in *every* case can be sketched, leaving to the discretion of the examiner the "leads" which are worth while following up by special examinations as indications may arise.

In the first place, a careful history must be taken, especially in regard to inheritance, exact occupation, home conditions and past illnesses. The importance of looking into the home conditions, such as family and marital relations, financial worries, etc., cannot be over-emphasized, since the group of psychoneurotic headaches depends largely on these factors; and psychoneurosis is one of the most frequent causes of the symptom. The history of the present illness should be taken in detail in order to obtain the facts concerning onset, duration, periodicity, and precipitating causes.

Next, the physical examination is taken up, and the organism studied in a thorough routine way, with special interest in a neurological examination which should include:

1. Cranial nerves, with ophthalmoscopic inspection of the fundus

2. Motor system, with inspection of muscular strength, gait, co-ordination and tremor
3. Reflexes, especially the knee jerks, ankle jerks and abdominals
4. Sensory system — which can usually be judged of by asking about subjective sensation, with quick tests of the cornea, pharynx and Romberg's sign
5. Sympathetic system — heart rate and pupillary reflexes to light and accommodation, with inspection of the skin for flushing and sweating
6. Endocrine system — thyroid, sex glands, skeleton, skin texture, and hair distribution
7. Temperature
8. Urine analysis

With a brief outline of this sort posted on the office wall, it adds remarkably little to the time of examination to note the positive findings, and in writing up the examination afterwards it is a great aid to have a list to remind one of omissions. The special examinations which will be found of most value are the Wassermann test; lumbar puncture; ophthalmological examination with special reference to visual fields; blood counts of red and white cells; X-ray of the skull, teeth and sinuses; transillumination; and stool examination. These procedures should be advised freely on the slightest indication, for the diagnosis is difficult at best and success often comes from unexpected sources.

Summary

Headache is a common complaint among industrial workers, causing in some units as much as 23 per cent. of the cases of lost time, and an average of 10 to 15 per cent. in the mercantile establishments studied by us. The causes of headache are many, but among the employees whom we examined acute infection, constipation, poor hygiene, psychoneurosis, and eyestrain, in the order named, were the commonest. A careful history with interest in personal and occupational problems is essential to diagnosis. The physical examination must be thorough and orderly, with emphasis on neurological findings, but it need not be time-consuming if carried out according to schedule.

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MEDICAL SUPERVISION IN INDUSTRY *

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Millions Sacrificed in Lost Time

An educational campaign is now being carried on to bring home to the large manufacturing employers the value of medical supervision in industry.

The loss to British industry through diminished effort due to indifferent health or actual illness is calculated at something like £2,000,000 a week. It is difficult to credit such a stupendous figure, but that, I am assured, is the Industrial Welfare Society's estimate of the fluctuation of labour thus involved.

Dr. E. L. Collis, late Director of Welfare and Health to the Ministry of Munitions, is not, however, dismayed by this figure, for he declares that by proper medical supervision it could be reduced by 70 per cent. — *Evening Standard, London, June 25, 1921.*

THE above paragraphs are of great interest and importance at the present time when the proportion of the physically fit of the male population has been reduced to a lower point than at any previous period by the ravages of the Great War. We are accustomed to think of the law of "conservation of energy" in its narrow physical sense, but in human life there is also the possibility of the conservation of energy in industry. In the present world-crisis it behooves us to do our utmost to prevent waste in all directions and especially in the direction of conservation of human life, in which too little has been done in the past.

Although the British government, working through the local authorities, has done much to promote the effective treatment of known cases of tuberculosis, no organized effort has been made to prevent persons in the early stages of tuberculosis, of heart disease, and of epilepsy from entering industrial life, and, in the case of tuberculous patients, to prevent them from infecting their fellow-workers. The system of medical supervision described in this communication has been in use for twenty-one years and has been adopted by a number of large employers of labor. It has the advantage of being easily carried out, and by careful examination of all candidates for factory employment many early cases of disease may be detected and dealt with before irremediable damage has been done to a growing boy or girl, placed in an unsuitable environment.

It has been objected that, by the application of what may be termed "recruiting methods" to candidates for employment in large factories, those who are rejected will be driven to seek employment in other smaller factories or workshops where conditions are worse. This argument would apply equally to all attempts to improve the hygienic condition of the industrial classes. For example, it may be argued that because the hygienic standards of large cities have not been enforced hitherto by the health authorities of smaller urban districts and rural areas, these standards should be lowered; or, to take another example, because the Overseas Dominions and the United States insist rightly upon a rigorous medical examination of all immigrants in order to protect their populations from the undesirables of Europe, that these barriers should be lowered lest the undesirable and the unfit be driven back to their place of birth.

In the present day, when the Great War has caused the death or disablement of several millions of the most robust of the male population, the paramount importance of conserving the health of the remaining workers by protecting them from infection and by finding suitable employment for

* Received for publication July 20, 1921.

those who show signs of disease which will incapacitate them for factory life in a few years, will readily be admitted.

The examination of the greater part of the male population of Great Britain between the ages of 18 and 41 by medical recruiting boards during the Great War revealed a large amount of disease and of physical defects among the industrial classes. Dr. Carey Coombs has recently stated * that "examination of the war office records shows that 10 per cent. of the total rejections were for 'V. D. H.'" The Prime Minister, in characteristically picturesque language, said a few months ago, "You cannot run an A I empire with a C III population." Although school medical officers and school clinics have done much to improve the physique of children in the public elementary schools, no such supervision is exercised generally after these children leave school and enter industrial life. If they choose factory employment, they are examined prior to entry by the certifying factory surgeon, and if he passes them as fit for employment they may have no further medical examination except on applying to a panel-doctor for admission to his panel. The choice of employment is usually left to the individual boy or girl, guided more or less by their parents, and, as Dr. Carey Coombs observes, there has been no concerted attempt to find suitable employment for patients who have suffered from rheumatism or from tuberculosis during school life. Many of these patients who have reached adolescence enter factories and may work for a few years before they finally break down.

There is no system in general use by which employers, managers, and heads of workshops can be interested in the detection of active or latent disease among their employees. The system about to be described was introduced in 1900 in some large cocoa and chocolate factories in which over 4,000 persons of both sexes are employed. All candidates for employment are examined, as for life assurance, in regard to the condition of their teeth, hair, eyes, tonsils, heart, lungs and vaccination. Any defects are noted on an index card and the applicant is referred for treatment to his doctor or sent to a hospital. In the case of a girl, the mother attends with the superintendent, and the importance of treatment of any defects, such as carious teeth, defective sight, or very enlarged tonsils, is pointed out: It has been found that over 60 per cent. of girls coming from public elementary schools have the nits of *pediculus capitis* in their hair, and in these cases the mother is instructed in the method of removing them. If the parents are willing to have necessary treatment carried out, the boy or girl is re-examined after this has been done, but in case of refusal to undergo treatment, the applicant is rejected. All persons with serious heart disease or tuberculosis are consistently rejected.

In addition to this system of medical examination, the forewomen or superintendents are instructed to bring any girl to the medical officer for examination, if they think she is out of health. To this end, periodical short lectures on infectious diseases, and particularly on tuberculosis, are given to the heads of departments and workrooms. If an employee develops symptoms of tuberculosis he is suspended (at full wages) pending admission to a sanatorium or hospital, and on discharge from the institution patients are assisted to obtain suitable outdoor employment, but unless there is evidence of complete arrest of the disease after repeated examinations, and unless tubercle bacilli have disappeared from the sputum, they are not permitted to return to the factories.

The adoption of this system of preliminary medical examination and subsequent supervision reduced the annual death rate

* Coombs, C.: British Medical Association Branch Meeting, Bristol, March 31, 1921.

among over 2,000 women and girls from 6 per cent. to less than 1 per cent., and during several years no deaths from any cause occurred. Prior to the adoption of medical examination and supervision, four or five employees died annually from tuberculosis, and before they became too ill to work these patients had inevitably infected others in their workrooms as well as in their own homes.

On March 23, 1921, the Minister of Health stated in the House of Commons that the deaths from all forms of tuberculosis during the last six years (1915–1920, inclusive) reached a total of 311,017—*i. e.*, an average annual death rate of 14.58 per *mille*. In other words, the deaths from all forms of tuberculosis during these six years amounted to 141.88 per *diem*, and if these patients had been collected in one center a population approximating that of Bath would have disappeared every year.

Dr. Addison observed that the figures for the last two years (46,312 deaths in 1919, and 42,505 deaths in 1920) were "the most encouraging since the inception of the scheme for the treatment of tuberculosis." It must, however, be remembered that, owing to the war and the subsequent wave of commercial prosperity, wages were high and unemployment had almost disappeared. Past experience shows that all great wars have been followed by commercial depression, with an inevitable increase in unemployment and its concomitants, underfeeding, underclothing, and overcrowding in ill-ventilated dwellings. There is reason to fear, therefore, that the annual death rate from tuberculosis will quickly reach, if it does not actually exceed, the pre-war figure, unless steps are taken speedily to deal more effectively with tuberculous patients among the industrial classes.

It must be admitted that, in spite of all that has been done during the last thirty years, the annual death rate from tuberculosis is a reproach to civilization. Under present conditions the majority of tuberculous patients are permitted to be employed in factories and offices until too ill to work. When they seek treatment it is found usually that the disease has reached so advanced a stage that there is no hope of cure, while at the same time they have frequently infected other members of their families and their fellow-workers. The following histories illustrate this point:

Case 1. — Harry P——, aged 54, was chief clerk to a firm of engineers. His youngest child (aged 12) died of tuberculous meningitis in 1906. Although there was a history of tuberculosis on both sides, neither he nor his wife nor their two surviving children showed any signs of the disease. In 1910, a clerk working opposite him died of pulmonary tuberculosis after a short illness. Although suffering from a severe cough with profuse expectoration, he was permitted to work until within a few weeks of his death. In 1912, H. P. developed an extensive infiltration of the upper lobe of the right lung with pleurisy at the right base. He was sent to a sanatorium in the Cotswolds for several months, and was then pensioned by his employers. A few months ago he was reported to be in good health.

Case 2. — Wilfrid S——, aged 26, was a clerk in one of the largest stores in London. When seen, he had returned to his home in Bristol in the last stage of pulmonary tuberculosis. He stated that three of his fellow-clerks working in one office had died of the same disease within two years.

Case 3. — Rose W——, aged 17, worked in a chocolate factory. She had been examined on leaving school two years earlier and remained in good health until six weeks before she was brought to the medical officer by her mother. She had extensive infiltration of the apices of both lungs with typical sputum containing numerous bacilli of bovine type. Her mother, who was very distressed, stated that her father had died recently after being an inpatient at the Bristol General Hospital under Dr. George Parker, to whom the writer is indebted for the particulars of his patient's last illness.

The father was a butcher employed at Avonmouth Docks. He came to the hospital with a diffuse cellulitis of the palm of the left hand, giving a history of having scratched himself when cutting up an ox. The hand was freely incised but the cellulitis did not subside, and a section of tissue showed giant cells with numerous tubercle bacilli of bovine type. He

quickly developed signs of massive infiltration of both lungs and was discharged as incurable. Before he could be sent to a sanatorium he committed suicide, when delirious, by jumping from his bedroom window.

Rose W—— died within three months of the onset of the disease, and, to complete this tragic family history, her brother (aged 14) died from tuberculous meningitis in the Bristol Royal Infirmary in 1913. The only satisfactory point in this case was that although Rose W——'s illness proved fatal, she was sent home before any of the other persons in the room in which she worked became infected. The forewoman was instructed to bring anyone who showed suspicious symptoms for immediate examination, but no other case occurred.

Although the detection and segregation of tuberculous patients has been emphasized on account of the wide distribution and serious results of tuberculosis among the population at large, it is obvious that a system which has proved successful in reducing the death rate from tuberculosis in a factory population of over 4,000 to less than 1 per *mille* per *annum* will be also applicable to the detection of cases of heart disease, epilepsy and other diseases, which, while affecting seriously the health and earning capacity of the person himself, are not direct sources of danger to his fellow-workers. The method is capable of wide application and development. For example, one company, employing over 10,000 workpeople, has adopted this system and insists on all "recruits" being vaccinated before commencing work in their factories and requires, in addition, that they sign an agreement to be revaccinated at any time that the company may require their workpeople to do so. Although it has been objected that this constitutes a technical "interference with the liberty of the subject," it has materially increased the percentage of the effectively vaccinated among the civil population of Bristol, and has thereby assisted the health department in preventing the spread of smallpox in several recent outbreaks which might have been serious among an imperfectly protected population.

In conclusion, it is satisfactory to learn that steps are now being taken by the British government to introduce a system of medical supervision in industry. Hitherto this matter has been left to the unaided efforts of a few far-seeing and enlightened employers, but it may be hoped that when the system is adopted on national lines those employers who have not hitherto realized the paramount importance of this subject will fall into line and aid the propaganda of the government.

THE FRAMINGHAM HEALTH DEMONSTRATION AND INDUSTRIAL MEDICINE*

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THE industrial relationships and contacts of the Framingham Community Health and Tuberculosis Demonstration have been extremely important in the development of the Framingham tuberculosis program. These industrial factors constitute the chief consideration of this paper. Perhaps a preliminary word, however, with reference to the character of the demonstration in general may be helpful.

The Framingham experiment, or demonstration, has now been under way for nearly five years, under the auspices of the National Tuberculosis Association, financed by a special contribution of from $150,000 to $200,000 to this association from the Metropolitan Life Insurance Company. This demonstration has aimed to answer certain pertinent questions in the tuberculosis field, such as: How much tuberculosis is there? What is the best way to treat it? How best can a community be organized for the eventual control and elimination of the disease? Naturally, the demonstration has had an intense interest in industry, as it is in the industrial age group that the highest tuberculosis death rates are usually found. Certainly, tuberculosis is in part, at least, an industrial disease.

The chief activities of the demonstration were briefly:

1. A general and sanitary survey, including a survey of industrial hazards.

2. Extensive medical examination campaigns, covering a large fraction of all age groups, including industrial workers.

3. An expert consultation service for the diagnosis of tuberculosis, offered to private physicians, factory medical and nursing staffs, etc.

4. The thorough organization of the community itself, not only for tuberculosis control but for general health and disease preventive work, including the fields of general community sanitation, infant hygiene, school hygiene, and industrial hygiene.

Among the most important results of these activities, from the general as well as from the special industrial viewpoint, the following may be mentioned:

1. The examination of a representative population indicates that about 1 per cent. is suffering from active tuberculosis.

2. A thorough search for tuberculosis cases indicates that there are nine or ten active cases, in an average community, to every annual death from tuberculosis.

3. Adequate medical machinery in schools, factories, and elsewhere is essential to the detection of tuberculosis. A full-time physician for every 2,500 school-children or factory workers is essential. The first consistent medical examination work of the school population of Framingham (about 3,000) disclosed eleven cases of active tuberculosis and sixty-nine suspicious cases hitherto undetected. The establishment of adequate medical machinery in the factories increased the percentage of new cases annually discovered through factory medical machinery from 0 to 27 per cent. over a period of three years.

4. The average community does not report more than 55 per cent. of its active

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tuberculosis in an early stage. Framingham experience has indicated that this percentage may be raised to 85.

5. The percentage of active tuberculosis cases receiving institutional care has been raised from 13 to 42 per cent.

6. The total health appropriations from both public and private sources have increased from 40 cents to about $2 per capita per year, the latter figure being set as an approximate standard for adequate community health work.

7. What will adequate machinery accomplish toward tuberculosis control and mortality reduction? Starting with a corrected tuberculosis mortality rate of 121 per hundred thousand as the average for the ten years preceding the demonstration, the rate fell to about one-half of that figure (64 per hundred thousand) in 1920, and present indications forecast a rate possibly in the neighborhood of one-fourth of the pre-demonstration rate for the current year (1921). This would indicate that the same measures, applied throughout the United States, would result in a saving of nearly 100,000 lives a year.

To return to the more important industrial considerations, it may be stated that there are in Framingham, at the outside, approximately 5,000 industrial workers. By far the largest industry, employing approximately one-half of this total, is a paper products plant where tags, boxes, and crepe paper articles are produced. Other industrial interests include carpet manufacturing, boiler construction, foundries, and the manufacture of shoes and automobile bodies.

The demonstration's approach to the solution of the tuberculosis problem has included two main efforts: first, a thorough survey of the industrial hazards of the community, carried out with the co-operation of the Massachusetts Board of Labor and Industry, the former New York Museum of Safety, and the New York State Commission on Ventilation, followed by an effort to correct the fundamental dangers to industrial workers; and second, an effort to encourage the local industries themselves, with necessary co-operation and aid at the start, to provide an adequate medical, nursing, clinic and dental service and personnel for the industrial employees.

On the side of personnel, when the work started there were employed by industries in the community one nurse and one part-time safety engineer. As a result of the co-operation which the industrial plants have given the demonstration during the past four years, it is now safe to say that between 70 and 80 per cent. of the industrial workers are under reasonably adequate medical, nursing and clinic supervision. The experience in the largest plant in the community, employing approximately 3,000 workers, is particularly illuminating from the point of view of employee interest in, enthusiasm for, loyalty to, and sympathy with the purpose and objectives of the medical and nursing program. This plant now employs a full-time physician and two nurses, and maintains an excellent clinic and first-aid establishment. The plant is organized on an advanced democratic profit-sharing and management-sharing basis, with considerable participation in control by employees of different grades, through industrial partnership, industrial associates, and shop committee devices.

This relationship between management and employees introduces certain novelties into the development of medical and nursing policies which might have seemed to a short-sighted view, in the beginning, to be obstacles, but which have, in reality, only the more firmly established the foundation for the program as a whole, Take, for instance, the matter of compulsory examination of new employees. It was not impossible to convince the management in this plant of the validity of the employment of

its medical and nursing machinery for this purpose. After the management was convinced, however, it was then necessary to convince the shop committee. Fortunately, the expert consultant of the health demonstration, Dr. P. C. Bartlett, has always worked in close co-operation with the members of the medical department in this plant, and, with their help, was able, by effective case histories of individuals ill with dangerous communicable diseases as found in this industry, to illustrate the importance of detecting such affections at the time of initial employment. The principle of compulsory examination was approved and was put through, with the backing of the management and of the men.

The members of the shop committee, employees in general, and the management, are now enthusiastic over the operation of this rule. It was not long after its application that the men themselves were asking: "If this is good for new employees, why isn't it good for all employees on a regular basis?" In fact, the next step has now been taken, and a system of regular periodic medical examinations for all employees, graded on the basis of age and period of employment, is now being experimented with.

Two or three other clinics with full-time nursing and part-time medical arrangements — in one instance with compulsory examination of new employees — have been developed in the community, and a plan promoted for the provision of a co-operative medical and nursing service for several of the smaller plants unable to provide full-time service for themselves. The actual establishment of this service is now dependent upon the more extensive revival of industrial activities.

While the Framingham experience has been on a relatively small scale, it has, nevertheless, been an intensive experience and may perhaps be legitimately used to suggest certain tentative standards for industrial medical work at large. It may even be possible to propose certain quantitative as well as qualitative standards. For instance, for an industrial unit of 2,500 people it would seem that there would be required at least one full-time physician and two full-time nurses, an adequate clinic equipment, some provision for dental service and at least part-time arrangements for safety. While the work of the medical and nursing staff may with advantage be organized as a fairly autonomous unit, it should, of course, be very closely related to certain other factory interests, such as the employment management service, the personnel division, the insurance or pension department, educational work, and welfare or recreation activities. Some of the functions of the medical and nursing staff would be:

1. The routine operation of the first-aid facilities and clinic, including the care for minor injuries and ills.

2. The diagnosis of chronic affections, with their reference to outside physicians of the individual's own choosing for continued treatment.

3. General health education by means of literature, lectures, bulletins, etc.

4. General safety work, machine guarding, etc.

5. General plant sanitation, including such matters as ventilation, cleanliness, water supply, etc.

6. Special class instruction, as, for instance, for groups of girls working on special types of machines, for whom group teaching in personal hygiene may be provided, covering such matters as posture, diet, clothing, and recreation.

7. Particular medical advice with reference to working and living adjustments for department heads and more responsible employees in the managerial class — a sort of local, intensified life extension service.

8. The regular examination of all new

employees, in co-operation with the employment department.

9. The regular periodic re-examination of permanent employees.

As previously indicated, it is our belief that medical and nursing facilities in industry can only be used to their full advantage if they are developed and operated in close co-operation with the labor groups concerned. These facilities must be used with a primary object of fitting the man to the job, and not as a device for the rigid elimination of the unfit from industry. It must be recognized by all that through the adaptation or, possibly, the elimination of a few will come the protection of many. It is probably unnecessary to say that such medical and nursing provision is a legitimate routine charge upon the industry, is, indeed, a thoroughly profitable investment, and should not be considered at all as a philanthropy which the employer provides for his employees.

Properly organized and promoted, an adequate medical and nursing service in industry will substantially decrease loss to the industry as a result of illness prevented, labor turnover reduced, etc. If the industry is intelligently organized on the basis of purposeful service, with the rational fundamental distribution of authority and responsibility, and with the necessary concomitant participation of workers in control, the medical service will be as useful as any other single device for enhancing the loyalty and devotional morale of the entire industrial group concerned. Adequate industrial medicine is an integral part of any decent physical foundation for a righteous industrial democracy.

STUDY OF ACCIDENT RECORDS IN A TEXTILE MILL*

PREPARED UNDER THE DIRECTION OF
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UNTIL about thirty years ago, industrial accidents were regarded as a part of the day's work, and, as such, were looked upon as largely inevitable. With the growth of the workmen's compensation laws in the various countries and states, a new mass of material on industrial accidents has been culled from the records which the states required to be kept. Through the study of this material the waste of accidents has been made apparent and the safeguarding of life and limb has become an industrial issue. In the words of Miss Ida M. Tarbell, accident prevention has become a "gospel which, defended as a sound economic policy, is practiced with the whole-heartedness and zeal of a religion."

The development of the idea of prevention of accidents through a study of records in which the underlying causes might be discovered followed the appreciation of the magnitude of the waste. Accidents are expensive. They mean loss of time, idle machinery, and retarded production to the employer, as well as time out of work, suffering, and hardship to the employee. The prevention of accidents has become a matter of national interest as is evidenced by the organization of the National Safety Council, the program of which is devoted to the stimulating of interest in industrial safety work, and by the fact that several states and many of the leading cities of the country have inaugurated campaigns along the same line.

In 1884, Germany adopted a comprehensive system of accident compensation on a national scale. Since it was the first country to adopt such a system, and one of the first to require the reporting of hours of incidence of accidents, it now furnishes the most valuable and complete statistics of industrial accidents. The Imperial Offices in 1887, 1897, and 1907 published valuable reports of specific studies of industrial accidents. The United States has been much slower in the investigation of industrial accidents. Among the earliest reports in the field is one published by the Wisconsin Bureau of Labor in 1909–1910, giving a brief table of accidents distributed according to the hours of occurrence. Today records of accidents are kept by practically all large establishments, but they vary widely in the fullness and care with which the information is entered. Examples of companies foremost from the point of view of the accuracy and care with which records are made are the International Harvester Company, Cheney Brothers, and the General Electric Company.

Scope of the Study

The material for the present study was obtained from the records of the Cheney Brothers Silk Mills in South Manchester, Connecticut. This company is deeply interested in preventive measures, and regards accident expense as a part of the cost of production. It has a comprehensive system of recording accidents, and requires reports made of every accident, no matter how slight.

The study covers 1,221 accidents which occurred during the year 1920. This year

* Received for publication June 11, 1921.

was considered to be fairly representative, and the fact that the numbers employed by the company suffered no marked decrease shows a contrast to the general depression which was reflected in many other establishments as the year progressed. The data were transcribed from the company's records to the schedule shown in Figure 1. The information, except that concerning age, marital condition, and number of children, was obtained from the original records made at the time of the occurrence of the accident. The data for the additional items were transcribed from the records of the employment bureau. The number of *persons* injured appears in the summaries as smaller than the number of *accidents* — a fact which should be kept in mind in studying the tables which follow. The scope of the study did not permit obtaining records of number of man-hours and the total number of days worked for all of the employees, and consequently it was not possible to present accident rates according to the method advocated by former Commissioner of Labor Statistics Meeker.* The number of accidents is therefore related simply to the numbers employed on the date specified.

FIGURE 1

ACCIDENT REPORT — CHENEY BROS.

NAME..... AGE..... MARRIED / SINGLE NO. OF DEPENDENT CHILDREN UNDER 16.....

OCCUPATION.....

DATE HOUR..... DAY..... MONTH..... YEAR .....

NATURE AND EXTENT .....

CAUSE.....

SURGICAL AID..... TIME WITH CO. .....

ACCIDENT DUE TO

- CARELESSNESS OF INJURED PERSON
- HAZARD OF TRADE
- CARELESSNESS OF FELLOW-WORKMEN
- DEFECT IN MACHINERY, TOOLS OR PREMISES

DURING NECESSARY PERFORMANCE OF WORK .....

UNDERSTANDS ENG. ..... TOTAL EXPENSE .....

CHARACTER OF ACCIDENTS

It is clear that the manufacture of silk does not necessarily carry a hazard of serious accident. For the most part, the accidents listed in Table 1 were of minor importance. The majority were slight cuts, abrasions, and bruises; the more serious accidents, such as scalp wounds and fractures, occurred more rarely. The contrast in the percentage of men and women workers who suffered from the various accidents is largely attributable to the different occupations requiring the use of different tools. In 1921 there were 2,891 men employed in the manufacturing operations in this factory, of whom 30.0 per cent. were injured, and 1,819 women, of whom only 19.4 per cent. were injured. The higher percentage of accidents to men is probably largely due to the fact that in silk

* This method is described in the Bulletin of the United States Bureau of Labor Statistics, Whole Number 234, 1918, pp. 52–66.

manufacture, as in most other industries, men are employed in more hazardous occupations than women.

The minor character of the accidents is shown in another way in Table 2, which gives the amount of time lost through accident. There were only ninety-six cases reported in which any time was lost, and fifty-seven of these incapacitated the worker for less than two weeks. In 945 cases, or 77.4 per cent. of the total, there was no loss of time. The majority of accidents studied were of minor importance from a financial standpoint as well as from the point of view of the amount of time lost (Table 3). In the case of nearly one-half (581) of the whole number of accidents, no financial outlay or compensation was reported. More than one-third (38.9 per cent.) of the 640 involving expense amounted to less than $5, and nearly two-thirds (65.6 per cent.) to less than $10. The case which resulted in the maximum expense ($807.58) was a compensation case following the amputation of an index finger injured by a picker stick.

Table 4 indicates that more than three-fourths (79.5 per cent.) of all the accidents which occurred in the mill were injuries to the hands (including fingers and thumbs) and arms. This obviously results from the greater exposure of these members in operating the tools and machines. When one considers that the weaver's hands may at any moment come in contact with the knife of the loom and the picker stick, that agility is required of a doffer to keep from injuring his hands in changing the bobbins, and that many times a day a knife must be used to clean the silk waste from a bobbin, it is not surprising that the hands and arms bear the brunt of the injuries. The number of accidents to the eyes is large, but is explained by the fact that even a tiny particle of dust lodging there was reported as an accident, though

TABLE 1. — NATURE OF ACCIDENTS

Nature of Accidents	Number of Accidents					
	Total		To Men		To Women	
	Number	Per Cent.	Number	Per Cent.	Number	Per Cent.
Total	1,221	100.0	868	100.0	353	100.0
Cuts	238	19.5	152	17.5	86	24.4
Lacerations	196	16.1	155	17.8	41	11.6
Abrasions	175	14.3	104	12.0	71	20.1
Bruises and abrasions or lacerations	138	11.3	103	11.9	35	9.9
Incisions	91	7.5	61	7.0	30	8.5
Strains and sprains	77	6.3	59	6.8	18	5.1
Foreign bodies in eyes	63	5.2	57	6.6	6	1.7
Punctures	62	5.1	41	4.7	21	5.9
Splinters and slivers	35	2.9	26	3.0	9	2.6
Burns	25	2.0	23	2.6	2	0.6
Infections	21	1.7	7	0.8	14	4.0
Scratches	10	0.8	8	0.9	2	0.6
Fractures	10	0.8	10	1.2	..	..
Blisters	7	0.6	4	0.5	3	0.9
Swellings	7	0.6	6	0.7	1	0.2
Inflammations	6	0.5	6	0.7	..	..
Scalp wounds	5	0.4	5	0.6	..	..
Abscesses	4	0.3	4	0.5	..	..
Hernia	3	0.2	3	0.3	..	..
Miscellaneous	48	3.9	34	3.9	14	3.9

TABLE 2. — LENGTH OF TIME LOST BECAUSE OF ACCIDENTS

Time Lost	Number of Accidents
Total	1,221
No time lost	945
Less than 1 week	29
Less than 1 day	2
1 day	4
2 days	7
3 days	7
4 days	2
5 days	6
6 days	1
1 week and less than 2	28
2 " " " " 3	9
3 " " " " 4	9
4 " " " " 5	4
5 " " " " 6	3
6 " " " " 7	4
7 " " " " 8	3
8 " " " " 9	0
9 " " " " 10	2
10 " " " " 11	0
11 " " " " 12	1
12 " " " " 13	1
13 " " " " 14	0
14 " " " " 15	1
15 " " " " 16	0
16 " " " " 17	0
17 " " " " 18	1
18 " " " " 19	0
19 " " " " 20	1
Not reported	180

it may have occasioned discomfort for a few moments only.

Cause and Responsibility

A large proportion of the accidents occurred in connection with the use of machinery, a fact which is a natural consequence of the extensive employment of machinery in textile industries. More than one-third (36.0 per cent.) of the accidents were so classified (Table 5). Hand tools, including such instruments as knives, scissors and hooks, were responsible for one-fifth of the whole number, but it should be remembered that the majority

TABLE 3. — EXPENSE OF ACCIDENTS

Expense in Dollars	Accidents	
	Number	Per Cent.
Total	640	100.0
1 and less than 5	249	38.9
5 " " " 10	171	26.7
10 " " " 15	75	11.7
15 " " " 20	40	6.3
20 " " " 25	20	3.1
25 " " " 30	17	2.6
30 " " " 35	7	1.1
35 " " " 40	12	1.9
40 " " " 45	4	0.6
45 " " " 50	5	0.8
50 and over	40	6.3

of these were slight injuries. This is also true of the remainder of the accidents, many of which were not hazards peculiar to the manufacture of silk.

In Table 6 the accidents are shown classified as they were reported in the factory record according to the responsibility for their occurrence. Two-thirds of the accidents (67.1 per cent.) were attributed to *hazard of trade*, and include such accidents as injuries to the hands incurred while putting belts on rollers, cutting the hands when working with reed wires, or contact with moving bobbins. *The carelessness of*

TABLE 4. — PART OF BODY INJURED

Location of Injury	Injuries	
	Number	Per Cent.
Total	1,221	100.0
Hands	834	68.3
Fingers	451	36.9
Thumbs	210	17.2
Palms and backs	173	14.2
Arms	136	11.2
Head and face	126	10.3
Eyes	71	5.8
Other	55	4.5
Feet	38	3.1
Torso	32	2.6
Legs	31	2.5
Shoulders	15	1.2
Miscellaneous	9	0.8

the injured person was the source of a second large group (24.7 per cent.). In order to show the full extent of individual responsibility as a factor, there must be added to the above the cases caused by the carelessness of the fellow-worker and the cases in which carelessness, together with defective machinery, was responsible, making a total of 335 cases, or 27.5 per cent. There is often disagreement as to whether carelessness has actually been shown. In the above case the judgment taken was that of the foreman reporting at the time of the accident. The large number of accidents due to these causes indicates roughly the extent to which the accidents might be prevented by the education of the worker in the importance of safety methods.

TABLE 5. — CAUSES OF ACCIDENTS

Cause	Number	Per Cent.
Total Accidents	1,221	100.0
Machinery	440	36.0
Tools	244	20.0
Falling, tripping, and slipping	86	7.1
Slivers, nails, tin, etc.	72	5.9
Lifting and moving	68	5.6
Flying particles	64	5.3
Rolling and falling bodies	59	4.8
Collisions with stationary bodies	36	2.9
Materials	28	2.3
Liquids	20	1.6
Glass	16	1.3
Miscellaneous	72	5.9
Not reported	16	1.3

Time of Occurrence

Practically all studies of accidents have shown a marked clustering in the latter part of the morning and afternoon periods. In the accidents grouped according to hour of occurrence, in Table 7 and Figure 2, peaks occurred between 10 and 11 o'clock in the morning, and between 3 and 4 in the afternoon. Similar peaks have usually been attributed to the fatigue of the worker which brings with it increased hazard in the worker's failing alertness. In the present instance, an explanation, which has not been hitherto emphasized in the literature of fatigue, was suggested by an official of the company and commended itself to the writers as an extremely reasonable one. He said:

> The facts are that the foremen are so rushed with supervisory duties in the early hours of the morning and afternoon, and the employees are so bent upon getting their work started and well in hand, that the minor accidents, which constitute a very large proportion of the whole, do not get attention until the breathing spell comes, about half past ten and half past three.

In the last hours of both periods fewer accidents occurred. A similar recovery has been noted in other accident studies and is attributed by Miss Josephine Gold-

TABLE 6. — RESPONSIBILITY FOR ACCIDENTS

Responsibility for Accidents	Number of Accidents	Per Cent.
Total	1,221	100.0
Hazard of trade	820	67.1
Carelessness of injured person	301	24.7
Defect in machinery	35	2.9
Carelessness of fellow-workman	25	2.1
Defect in premises	11	0.9
Carelessness of injured person and defect in machinery, tools, or premises	5	0.4
Carelessness of injured person and of fellow-workman	4	0.3
Defect in tools	3	0.2
Not reported	17	1.4

mark * to the decreased number at work during the last hours and to the fact that the worker, having reached a high point of fatigue, unconsciously slows down in the last hour and in this way decreases the risk. Anticipation of the coming rest period has also been suggested as a cause of decrease in the number of accidents

* Goldmark, J.: Fatigue and Efficiency. New York, Russell Sage Foundation, 1912, pp. 77, 78.

during the last hour of work. Conversely, the large number of accidents at the peak hours has been attributed to the fact that as the work progresses the employee becomes more accustomed to it and works at a higher speed, and when this high speed is attained, the increased repetition of an act gives increased opportunity for accident. A slightly different point of view was held at the Cheney Mill, where the rapid falling off toward noon and 4 o'clock was attributed to the unwillingness of the workers to take time off just before they were going home. This, and "not any psychological state of mind or condition of fatigue," was advanced as the cause of the character of the curves noted.

TABLE 7. — OCCURRENCE OF ACCIDENTS BY HOURS

Hour	Accidents	
	Number	Per Cent.
Total	1,221	100.0
7– 8 A.M.	48	3.8
8– 9	102	8.4
9–10	134	11.0
10–11	154	12.6
11–12	113	9.3
12– 1 Lunch Hour	15	1.2
1– 2 P.M.	90	7.4
2– 3	123	10.1
3– 4	130	10.6
4– 5	107	8.8
5– 6	15	1.2
6 and after	7	0.6
Not reported	183	15.0

The accident risk does not appear so great in the first and last hours of the morning and afternoon because it is usually not possible to make allowance in the first hour for the number who are late, and in the last hour for the employees who usually spend the last few minutes in getting ready to go home and who are, consequently, not exposed. The first hour of the afternoon has a higher percentage than the first hour of the morning, which may be partly due to the fact that the fatigue is then greater.

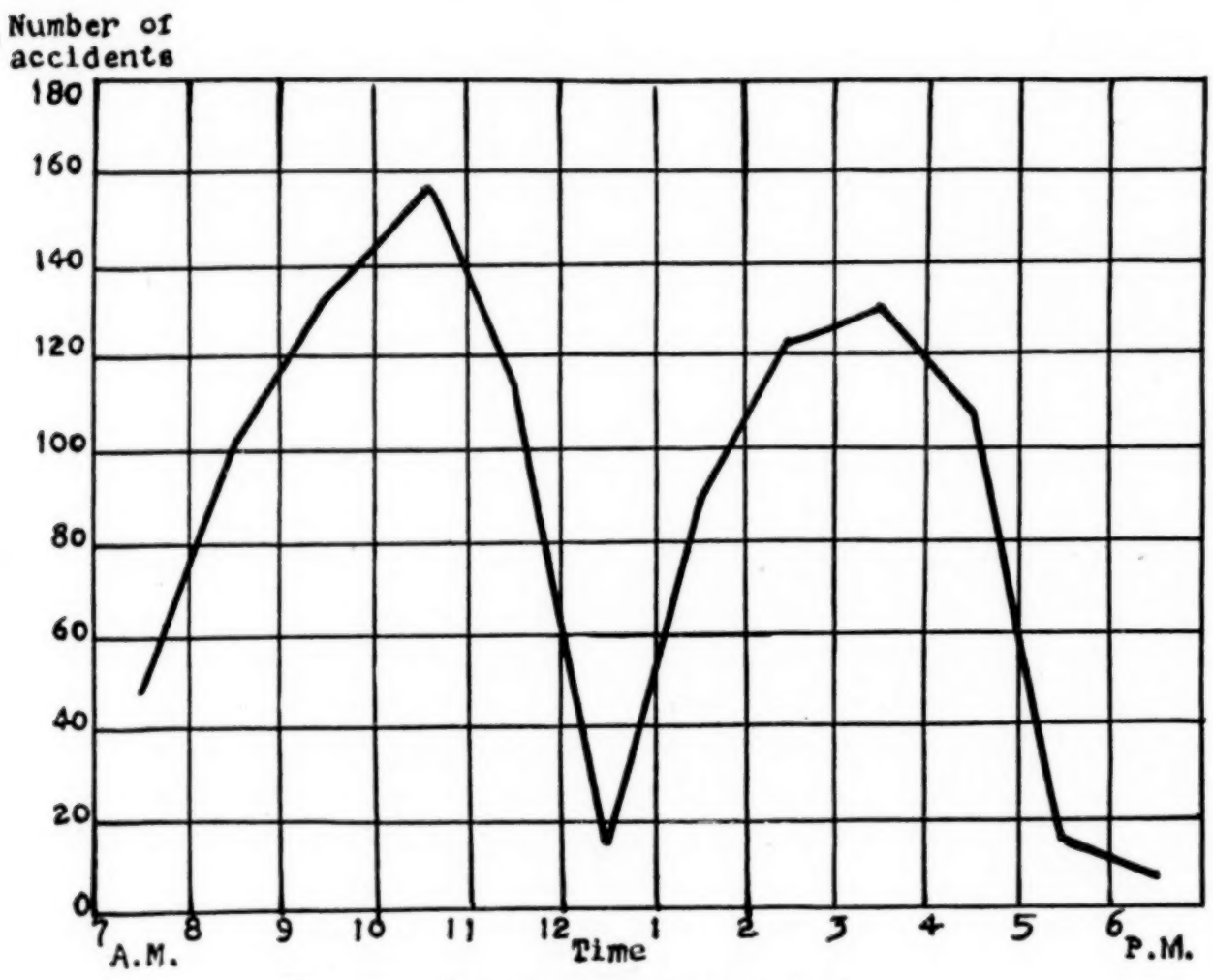

FIG. 2. — Occurrence of accidents by hours.

In a similar investigation* of accidents in textile mills covering the calendar years 1918 and 1919, the peak hours were found to be 9 in the morning and 3 in the afternoon. The author suggests that regularly recurring psychological and physiological cycles, such as mid-morning and mid-afternoon drowsiness as a consequence of eating, may also be important factors, as well as the increased risk with the higher speed following the low mental period.

A marked variation in the number of accidents on different days of the week is probably accounted for as much by out-

* Gates, D. S.: A Statistical Study of Accidents in the Cotton Mills, Print Works, and Worsted Mills of a Textile Company. JOUR. INDUST. HYG., 1920–1921, **2**, 287.

side factors causing fluctuation of the attention as by differing degrees of fatigue. In a study of the accidents in the Burroughs Adding Machine factory for the years 1919 and 1920, the disturbing effect of pay day is stressed.

In the year 1919 the factory day force was paid Saturday noon and the night force Friday evening; consequently, it is found that more accidents resulted on Fridays and Saturdays than on any other day of the week. In 1920, pay day was so arranged that certain sections of the factory were paid on different days of the week; a lowering of accidents per day was at once noticed.*

TABLE 8. — OCCURRENCE OF ACCIDENTS BY DAYS

Days	Accidents	
	Number	Per Cent.
Total	1,221	100.0
Monday	227	18.6
Tuesday	190	15.6
Wednesday	229	18.8
Thursday	194	15.9
Friday	226	18.5
Saturday [1]	106	8.7
Sunday	17	1.3
Not reported	32	2.6

[1] Saturday is a half-day.

In the present study, Monday, Wednesday and Friday stand out as days when more accidents occurred. (Table 8 and Figure 3.) The high percentage on Monday may be occasioned by the fact that it is difficult to settle down to the routine of work after the Saturday afternoon and Sunday break. Possibly the Wednesday peak is to be attributed to the facts that Tuesday is pay day and the stores in the town are open on Tuesday night. The sequence is repeated on Thursday and Friday. It is reasonable to assume that many of the workers go out on Thursday evenings since that is the night for the change of feature at the moving pictures. After Friday the drop in the Saturday accident rate is not so great as the drop from the high rates of Monday and Wednesday, when the fact that Saturday is only a half-day is allowed for. Saturday morning is a period of anticipation of Saturday afternoon good times; the worker's mind is occupied partly with plans for the afternoon and is not wholly devoted to his work. Another cause for the accumulation of accidents near the end of the week is probably the haste of the pieceworkers, in their attempt to catch up after "taking it easy" at the beginning of the week. In their haste they are liable to become careless and are subject to a greater accident

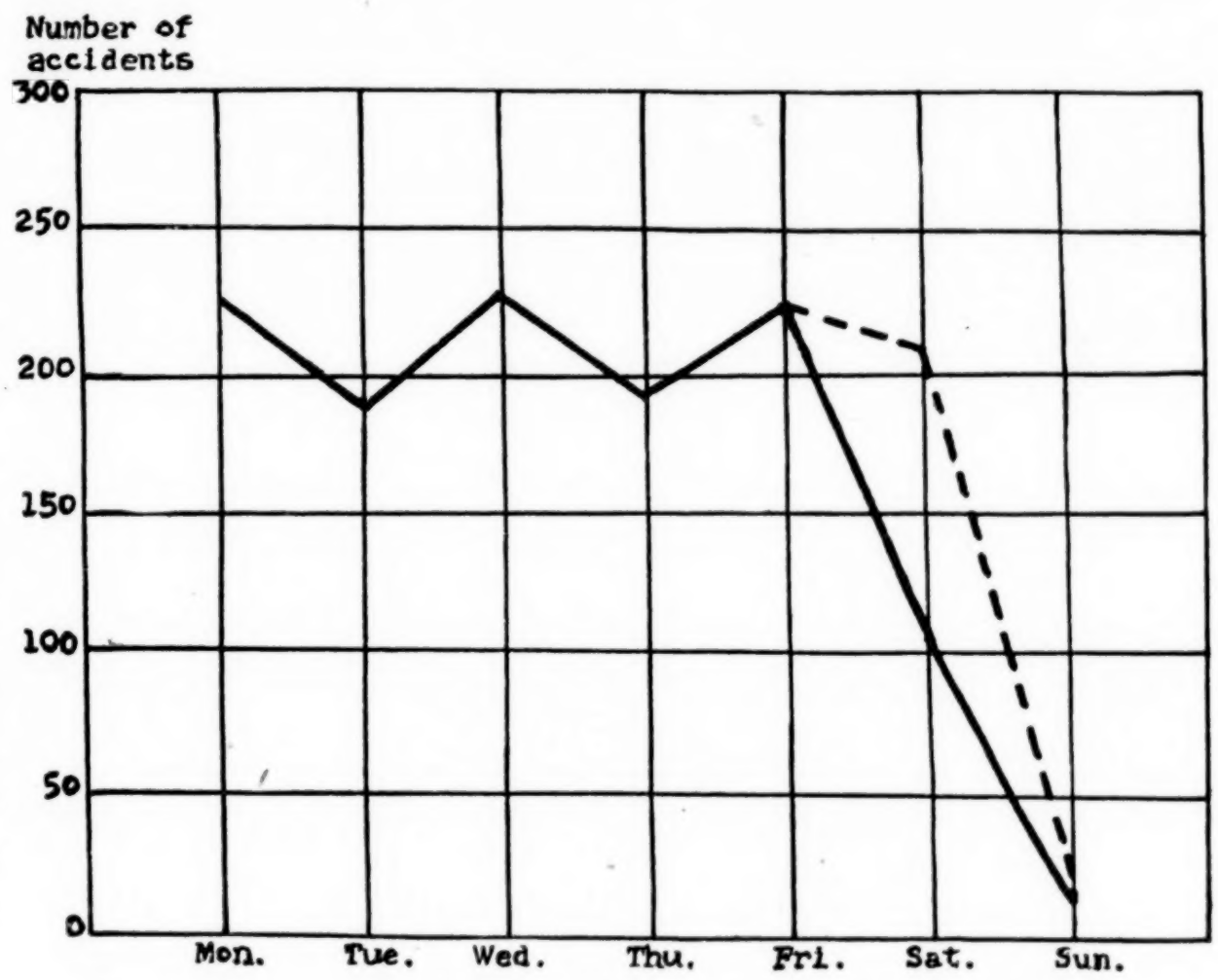

FIG. 3. — Occurrence of accidents by days. The dotted line is carried to a point which indicates twice the number of accidents which actually occurred, since Saturday is a half-holiday.

* State of Mind the Largest Contributor to Safety. Burroughs Magazine, April, 1921, p. 5.

risk. Added to these causes is the cumulative fatigue of the week's work.

Age and Sex of Injured Person

The findings of this study show clearly that age is an important factor in the accident rate. The employees under 20 years of age met with a larger proportion of accidents than did those in any other age groups — a fact which supports the statements in the study of textile accidents made by Mr. Donald S. Gates, referred to above, to the effect that the younger employees (in the latter instance those 18 years of age) were subject to the greatest accident risk.

Table 9 and Figure 4 show the age distribution of the injured persons and the relationship of the number of injuries incurred by employees of the various age groups to the total numbers of those ages employed. It must be remembered that the accident figures used in this table refer to the *number of accidents*, and the fact that numbers of *individuals* suffered more than one injury is ignored in the table itself. The strikingly larger proportion of men than women among the injured, already noted, holds for almost every age group.

Table 9 shows not only the high accident rate for the younger employees, and especially the younger men, but also the significant fact that the decrease of risk with increasing age is to some extent regular, with the exception of the fact that the employees from 30 to 35 years fared better than their fellow-employees who were slightly older. The numbers of employees who were past middle age were so small that no attempt can be made to interpret the figures which pertain to them.

TABLE 9. — ACCIDENT EXPOSURE BY AGE AND SEX

Age of Injured	All Employees			Men			Women		
	Number [1]	Accidents		Number	Accidents		Number	Accidents	
		Number	Rate per 100 Workers		Number	Rate per 100 Workers		Number	Rate per 100 Workers
Total	4,710	1,221	25.9	2,891	868	30.0	1,819	353	19.4
Less than 15	35	13	37.1	7	8	114.3	28	5	17.9
15 and less than 20	671	288	42.9	305	181	59.3	366	107	29.2
20 " " " 25	772	216	27.9	393	145	36.9	379	71	18.7
25 " " " 30	763	161	21.1	474	113	23.8	289	48	16.6
30 " " " 35	681	136	19.9	458	109	23.8	223	27	12.1
35 " " " 40	533	120	22.5	343	98	28.6	190	22	11.6
40 " " " 45	384	78	20.3	257	66	25.7	127	12	9.4
45 " " " 50	305	64	20.9	211	47	22.3	94	17	18.1
50 " " " 55	241	41	17.0	182	29	15.9	59	12	20.3
55 " " " 60	157	29	18.4	122	24	19.7	35	5	14.3
60 " " " 65	114	12	10.5	92	10	10.9	22	2	9.1
65 and over	54	6	11.1	47	5	10.6	7	1	14.3
Not reported	..	57	..	..	33	..	..	24	..

[1] Number of persons employed January 1, 1920.

The peculiar susceptibility of young people to accidents is probably due to a combination of influences, of which inexperience and unfamiliarity with the work and the necessary precautions, carelessness and a form of bravado, lack of attention and concentration due to lack of training, as well as possible greater exposure to the objective dangers of their

trades play a part. For the most part, the accidents to the younger persons were not disabling.

An examination of the individual records also showed that the young people tended to encounter more than one injury to a greater degree than did older persons. Approximately one-half (47.2 per cent.) of the 212 persons who had more than one accident were between 14 and 25 years old, though this group constituted less than one-third (31.4 per cent.) of the whole number of employees. The individual who had the maximum number of accidents during the year — eleven — was also a member of this younger group. The fact that the majority of the accidents were of small consequence prevented the experience from having much of the quality of a warning which would teach more caution next time.

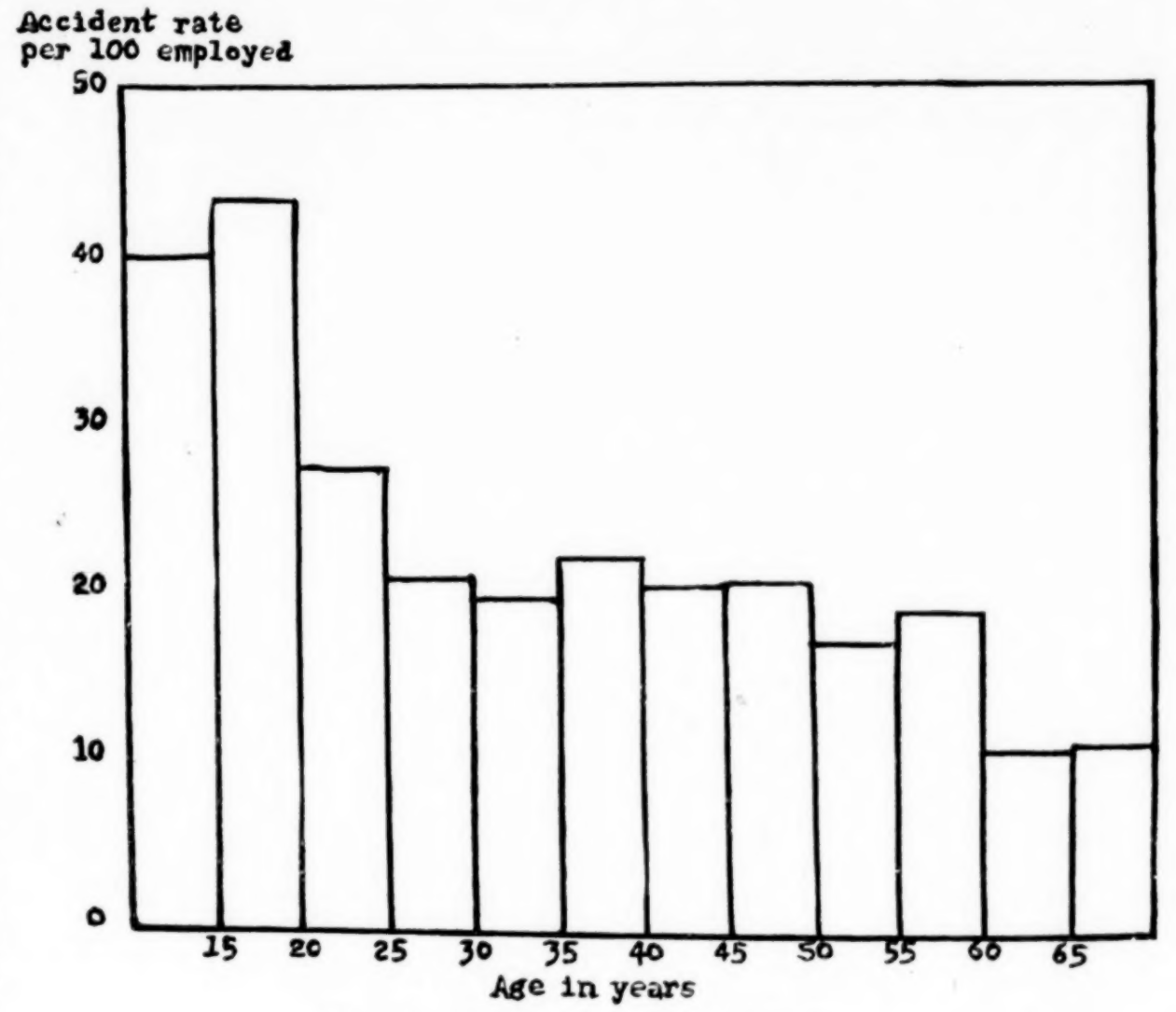

FIG. 4. — Accidents according to age.

The study offers evidence to prove that a careful system of reporting accidents and immediate care of injuries are effective factors in a program of accident prevention. There is little room for doubting that the practice of giving prompt attention to even the slightest injuries is one of the best reasons why so few accidents at the Cheney plant entailed serious consequences. It is safe to say that treatment of an insignificant cut has many times prevented serious infection.

Accident rates in many states have been reduced by laws compelling the guarding of machines, but the passing of state laws can do little to eliminate human carelessness. In the study of accidents made at the Burroughs Adding Machine factory it was contended that "state of mind" was the largest contributor to safety. Since evidence of carelessness is particularly marked in the workers under 20 at the Cheney plant, it becomes apparent that special attention should be directed to the younger workers and perhaps particularly to the young men in a campaign for the further prevention of industrial accidents.

BOOKS RECEIVED

Books received are acknowledged in this column, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

Government Control and Operation of Industry in Great Britain and the United States During the World War. By Charles Whiting Baker, C.E. Carnegie Endowment for International Peace. Preliminary Economic Studies of the War, No. 18. Edited by David Kinley, Professor of Political Economy, University of Illinois; Member of Committee of Research of the Endowment. Paper. Pp. 138 with index. New York: Oxford University Press, 1921.

Government War Contracts. By J. Franklin Crowell, Ph.D., LL.D. Carnegie Endowment for International Peace. Preliminary Economic Studies of the War, No. 25. Edited by David Kinley, Professor of Political Economy, University of Illinois; Member of Committee of Research of the Endowment. Paper. Pp. 357 with index. New York: Oxford University Press, 1920.

The Control of Sex Infections. By J. Bayard Clark, M.D., Fellow of the New York Academy of Medicine; Fellow of the American College of Surgeons; Member of American Urological Association; American Association Genito Urinary Surgeons; International Surgical Society; Sometime Major Medical Corps U. S. Army, etc. Cloth. First Edition. Pp. 132 without index. New York: The Macmillan Company, 1921.

Nerves and the Man. A Popular Psychological and Constructive Study of Nervous Breakdown. By W. Charles Loosmore, M.A., Brown Scholar at Glasgow University. Cloth. Pp. 223 with index. New York: George H. Doran Company, 1921.

Epidemic Respiratory Disease. The Pneumonias and Other Infections of the Respiratory Tract Accompanying Influenza and Measles. By Eugene L. Opie, M.D., Colonel, M.R.C., U. S. Army; Professor of Pathology, Washington University School of Medicine; and Francis G. Blake, M.D., Major, M.R.C., U. S. Army; Associate Member of the Rockefeller Institute for Medical Research; and James C. Small, M.D., Formerly First Lieutenant, M.C., U. S. Army; Bacteriologist, Philadelphia General Hospital; and Thomas M. Rivers, M.D., Formerly First Lieutenant, M.C., U. S. Army; Associate in Bacteriology, Johns Hopkins University. Cloth. First Edition. Pp. 402 with illustrations, index, and appendix. St. Louis: C. V. Mosby Company, 1921.

Henley's Twentieth Century Formulas, Recipes and Processes. Containing Ten Thousand Selected Household and Workshop Formulas, Recipes, Processes and Money Saving Methods for the Practical Use of Manufacturers, Mechanics, Housekeepers and Home Workers. Edited by Gardner D. Hiscox, M.E. Cloth. 1921 Edition, Revised and Enlarged. Pp. 807 with index. New York: The Norman W. Henley Publishing Company, 1921.